

# Draft DFIRM Spatial Database Design Document

## Map Modernization Mission and Objectives

Since the 1970s, FEMA has been creating, storing, and updating flood hazard maps for NFIP communities across the United States. Over the same time period, there has been a computer revolution -- from mainframes to PCs to local area networks to the Internet. Advancements in hardware and software have enabled a mapping revolution -- from manual cartography to computer-aided design to GIS to real-time high-resolution digital satellite imagery.

FEMA maintains warehouses of paper maps, flood profiles, Letters of Map Change, and other paper data supporting the day-to-day work of the NFIP. Through our **Map Modernization Program**, we plan to take advantage of technology to automate these products where possible, especially in the development of our mapping products. As we move toward the next century, our goal is to work cooperatively with our Federal, State, and local partners to bring greater flexibility, access, accuracy, and efficiency to the process of creating and disseminating flood hazard maps.

As part of the development of the new DFIRM product, a DFIRM spatial database has been designed and is discussed in this document. The DFIRM spatial database will store the digital data used in the map production process, as well as the back-up engineering data for the floodplain studies. This database will provide a standard, systematic method for FEMA to distribute comprehensive details of its flood studies to the public. In addition, the database will be used by FEMA's contractors and mapping partners and will facilitate the development, open exchange, and dissemination of DFIRM data and the rapid map update objectives of the Map Modernization Program.

## DFIRM Spatial Database Objective

### **Develop product specifications and integrated engineering and mapping database structures supporting FEMA's new DFIRM products.**

The DFIRM spatial database design work group has taken a comprehensive approach to capturing the full array of data elements and attributes comprising the end-to-end engineering and mapping processes required to generate FEMA's DFIRM products. All aspects of data collection and processing have been analyzed to support the tasks of FEMA's Study Contractors (SCs), Flood Map Production Coordination Contractors (FMPPCs), communities, collaborating Federal agencies, partners, customers, and end-users.

The objective of the DFIRM spatial database is to facilitate the collection, storage, processing, and access to data developed by FEMA for the NFIP. The DFIRM spatial database will enable FEMA's partners and contractors to share data necessary for the DFIRM production and conversion process. In addition, it will enable rapid map

updating and revisions in the future. Where possible, all mapping and engineering data elements have been linked to physical geographic features and georeferenced. The use of GIS as a component of the DFIRM spatial database provides the ability to georeference and overlay the mapping and engineering data. This allows the spatial database to support a wide variety of existing and visionary FEMA engineering and mapping products, such as digital mapping; automated hydrologic and hydraulic (H&H) modeling; automated mapping; Web-based publishing of digital map products; and direct links between base maps, work maps, H&H modeling, and mapping elements.

The DFIRM spatial database design is currently very large in scope and defines a structure for archiving and sharing virtually all engineering and mapping data collected by FEMA during DFIRM production. The Standard DFIRM Spatial Database (SDSD) product includes all of the features shown on the paper DFIRM and can be distributed as an easy-to-use subset of the DFIRM spatial database product. It may also include some engineering data not shown on the paper DFIRM (e.g., intermediate cross sections, transects, cross-section elevations, etc.). The Enhanced DFIRM Spatial Database (EDSD) containing the back-up engineering data can be distributed as needed to contractors and communities tasked by FEMA to perform flood studies, map revisions, or map maintenance. In addition, any given flood study, revision, or DFIRM conversion may only result in the population of a subset of the total database, as dictated by the scope, methods, and data requirements of the task.

#### Scope Defined by the DFIRM Spatial Database Team

The DFIRM spatial database work group began its work by defining the scope of the new product. Among the objectives the group considered important were the inclusion of all current DFIRM data elements, as well as new elements to support paper DFIRM output, and complete archiving of the Flood Insurance Study data.

##### A. SDSD Elements:

The SDSD elements were designed to allow users to determine whether a structure is in or out of the Special Flood Hazard Area, determine a BFE for the structure, and identify other basic information needed to rate an NFIP flood insurance policy. Thus, all of the standard features currently included in the paper FIRM product were included. Additional information about those elements beyond what can be seen on the paper map was added, where appropriate. The SDSD elements include the following:

- DOQ or transportation features
- Public Land Survey System
- Horizontal reference grid
- Flood hazard areas (1% and 0.2% annual chance flood hazard areas and floodways)
- Hydrographic features (streams, lakes, shorelines)

- FIRM panel areas, including the effective date, size, scale, and corner coordinates and a link to Panel / CID table(s)
- Political areas (corporate and county boundaries as well as National Parks, forests, and military lands)
- USGS 7.5-minute quadrangle areas
- Coastal Barrier Resources System (CBRS) areas
- BFE lines
- Mapped cross section lines, including the BFEs added from the Flood Insurance Study (FIS)
- Coastal transects
- Permanent benchmarks with NGS identification number allowing link to external NGS information
- Elevation Reference Marks
- Structures (dams, bridges, culverts, weirs, etc.)
- Levees

#### B. Enhanced DFIRM Spatial Database (EDSD) Elements:

The EDSD was designed to archive in an electronic and systematic format all of the data collected during the production of a Flood Insurance Study. The EDSD includes enhanced features not included in the SDSD that support engineering and modeling applications. Some of these enhanced features may be stored in GIS mapping layers or related tables but not shown on the paper DFIRM. Examples of these features include contours or DEM data, stream reaches, soils, land use, basin and sub-basin outlines, and high-water marks. Individual points along features such as cross sections are also included. Additionally, related tables that store engineering input and output data have been created. These tables can be related to certain mapped features, such as structures, cross sections, or basins.

These EDSD data elements were presented in the first review phase and will be updated in the near future. However, this current update to the DFIRM spatial database focused on the SDSD elements only.

#### C. Metadata:

The DFIRM spatial database is designed to accommodate the storage of metadata (or data about the data) at multiple levels. Metadata can be stored at the individual feature level if different features in one map layer were derived from multiple sources. The use of feature-level metadata will support future map updates by FEMA or its partners that revise only portions of a DFIRM.

Metadata can be stored at the thematic level if all of the features in that theme were derived from a single source at the same time. A user will also be able to generate project level metadata that summarizes the feature and thematic metadata. The metadata tables are designed to support the output of metadata files that are compliant with the Federal Geographic Data Committee's latest metadata standards.

#### D. Planned Features:

For various reasons, certain mapping elements have not yet been included in this draft. The items not in this current design include future conditions hydrology and mapping, graphic symbology and annotations, alluvial fans, and erosion and other hazards. These items may be included at a later date when the standards that apply to them are finalized. Given the modular nature of the database tables, adding new data tables should be straightforward and will allow the database to grow to meet FEMA's evolving needs.

#### Review Comments

This draft SDSD design and prototype is being circulated for review to FEMA's customers, partners, and contractors. The SDSD design will be implemented based on the lessons learned from prototyping and feedback from reviewers. Additionally, work will continue on the EDSD design, and its revised draft will be circulated for review when complete.

#### Additional Information

Please refer to the FEMA Map Modernization web site for additional information concerning the DFIRM spatial database. The web site contains the following:

1. Draft DFIRM Spatial Database Design Document
2. New DFIRM Product Development
3. FEMA's DFIRM Spatial Database Product Definition
4. DFIRM Prototype Metadata File
5. SDSD Table/Field Definition
6. Microsoft Access SDSD Tables
7. DFIRM Prototype data sets in Shapefile format
8. DFIRM Prototype Flood Insurance Study Text and Profiles in PDF format
9. Readme File